M.Sc. (Biochemistry): 2-Years Semester Course

SEMESTER I

BCC 101	Theory (Core) 1	Cell Biology and Physiology	4
BCC 102	Theory (Core) 2	Biomolecules and Microbial Biochemistry	4
BCM 301	Theory (Elective Minor) 3	Bioanalytical Techniques	4
BCM 302	Theory (Elective Minor) 4	Nutritional Biochemistry	4
BCP 401	Practical (Major elective) 1	Bioorganic Preparations and Analytical Biochemistry	6
Total –		**SEMESTER I**	**22**

SEMESTER II

BCC 103	Theory (Core) 5	Methods in Molecular Biology	4
BCC 104	Theory (Core) 6	Bioenergetics and Metabolism I	4
BCC 105	Theory (Core) 7	Metabolism II	4
BCC 106	Theory (Core) 8	Immunology	4
BCP 402	Practical (Core) 2	Bioanalytical Techniques	3
BCP 403	Practical (Core) 3	Microbiology and Immunology	3
BCS 501	Seminar (Minor Elective) 1	Assignment based Seminar	1
Total -		**SEMESTER II**	**23**

SEMESTER III

BCC 107	Theory (Core) 9	Enzymology	4
BCC 108	Theory (Core) 10	Plant Biochemistry	4
BCC 109	Theory (Core) 11	Clinical Biochemistry	4
BCE 201	Theory (Major Elective) 12	Molecular Biology	4
BCP 404	Practical (Core) 4	Biochemical Preparations and Clinical Biochemistry	6
BCS 502	Seminar (Major) 1	Assignment based Seminar	1
Total -		**SEMESTER III**	**23**

SEMESTER IV

BCE 202	Theory (Major Elective) 13	Neurobiochemistry	4
BCE 203	Theory (Major Elective) 14	Outlines of Biotechnology	4
BCP 405	Practical (Core) 5	Enzymology and Enzyme Technology	6
BCS 503	Seminar (Major)	Assignment based Seminar	2
BCP 601	Project (Major)	Project Work Including Presentation, Comprehensive viva	6
Total -		**SEMESTER IV**	**22**
		TOTAL CREDITS	**90**

BCC = Biochemistry Core Theory Papers
BCM = Biochemistry Minor Elective Theory Papers
BCE = Biochemistry Major Elective Theory Papers
BCP = Biochemistry Practical Papers, Project
BCS = Biochemistry Seminar Papers.

SEMESTER I

Paper - 1 (Core): BCC 101: Cell Biology and Physiology

Credits - 4
Marks: 100

1. **Cell Biology –** Cell classification, cell variability (size, shape, complexity, functions). Structural organization of prokaryotic and eukaryotic cells. The ultra structure of nucleus, mitochondria, endoplasmic reticulum (rough and smooth), Golgi apparatus, lysosomes & peroxisomes and their functions. The cytoskeleton – microtubules and microfilaments. Cell movement and chemotaxis.(8)
2. **Blood –** Composition and functions of plasma, erythrocytes including Hb, Leucocytes and thrombocytes, plasma proteins. Blood coagulation – mechanism and regulation. Transfer of blood gases – Oxygen and carbon dioxide, role of 2,3-diphosphoglycerate, Bohr's effect and chloride shift. (10)
3. **Digestive system –** Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. (10)
4. **Respiration –** Air passages and lung structure, pulmonary volumes, alveolar surface tension, work of breathing and its regulation. (5)
5. **Excretory system –** Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Homeostatic regulation of water and electrolytes, Acid-base balance. (7)
6. **Endocrine system –** Secretion and functions of hormones of thyroid, pituitary and gonads. Role of hormones in reproduction and pregnancy. Mechanism of action of hormones. (12)

Paper – 2 (Core): BCC 102: Biomolecules and Microbial Biochemistry

Credits:4
Marks: 100

Bio-molecules:

1. **Carbohydrate –** Classification, structure, general properties and functions of polysaccharides and complex carbohydrates; amino sugars, proteoglycans and glycoproteins. (8)
2. **Lipids –** Classification, structure, properties and functions of fatty acids, essential fatty acids, fats, phospholipids, sphingolipids, cerebrocides, steroids, bile acids, prostaglandins, lipoamino acids, lipoproteins, proteolipids, phosphatidopeptides, lipopolysaccharides. (8)
3. **Proteins –** Peptide synthesis: chemical and Merrifield synthesis. Primary (peptide conformation, N- and C- terminal, peptide cleavage), Secondary (α-helix, sheet, random coil, Ramachandran plot), Tertiary and Quaternary structures of proteins. (10)
4. **Enzymes –** Historical perspective, general characteristics, nomenclature, IUB enzyme classification (specific examples), measurement and expression of enzyme activity, enzyme assay. Definitions of IU, Katal, enzyme turnover and specific activity. Methods for isolation, purification and characterization of enzymes, tests for homogeneity of enzyme preparation. (8)
5. **Nucleic acids –** Nucleic acids as genetic information carriers, experimental evidence e.g., genetic transformation, Hershey-Chase experiments, action spectrum, etc. Structure and function of

nucleotides. Primary, secondary and tertiary structure of nucleic acids, DNA forms and conformations, Denaturation of DNA. (8)

Microbial Biochemistry:

6. **Morphology and structure** of bacteria, gram positive and gram negative organisms. Microscopy (Bright field, Dark field, Phase contrast and Fluorescence microscopy), sterilization, nutritional requirements and growth characteristics of bacteria, media for growing bacteria and fungi. (8)
7. **Bacterial toxins –** Classification, structure and mode of action of bacterial protein toxins. (2)
8. **Viruses –** General structure, properties and classification. (3)

Paper – 3 (Minor Elective): BCM 301: Bioanalytical Techniques

Credits: 4
Marks: 100

1. **Spectroscopy –** Concepts of spectroscopy, Visible and UV spectroscopy, Laws of photometry. Beer-Lambert's law, Principles and applications of colorimetry (5)
2. **Chromatography –** Principles of partition chromatography, paper, thin layer, ion exchange and affinity chromatography, gel permeation chromatography, HPLC and FPLC (10)
3. **Centrifugation –** Principles of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation. (10)
4. **Electrophoretic techniques –** Principles of electrophoretic separation. Continuous, zonal and capillary electrophoresis, different types of electrophoresis including paper, cellulose, acetate/nitrate and gel. Electroporation, pulse field gel electrophoresis. (10)
5. **Viscosity –** Viscosity of macromolecules, relationship with conformational changes. (2)
6. **Electron microscopy –** Transmission and scanning, freeze fracture techniques, specific staining of biological materials. (5)
7. ORD, CD, X-ray diffraction, X-ray absorption, NMR. (8)

Paper - 4 (Minor Elective): BCM 302 : Nutritional Biochemistry

Credits-4
Marks: 100

1. **Basic concepts –** Function of nutrients. Measurement of the fuel values of foods. Direct and indirect calorimetry. Basal metabolic rate: factors affecting BMR, measurement and calculation of BMR. Measurement of energy requirements. Specific dynamic action of proteins. (10)
2. **Elements of nutrition –** Dietary requirement of carbohydrates, lipids and proteins. Biological value of proteins. Concept of protein quality. Protein sparing action of carbohydrates and fats. Essential amino acids, essential fatty acids and their physiological functions. (10)
3. **Minerals –** Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper. (8)
4. **Vitamins –** Dietary sources, biochemical functions, requirements and deficiency diseases associated with vitamin B complex, C and A, D, E & K vitamins. (10)

5. **Malnutrition –** Prevention of malnutrition, improvement of diets. Recommended dietary allowances, nutritive value of common foods. Protein-calorie malnutrition. Requirement of proteins and calories under different physiological states- infancy, childhood, adolescence, pregnancy, lactation and ageing. (10)
6. **Starvation –** Techniques for the study of starvation. Protein metabolism in prolonged fasting. (2)
7. **Obesity –** Definition, Genetic and environmental factors leading to obesity. (2)

Practical Paper – 1 (Major Elective): BCP 401:
Bioorganic Preparations and Analytical Biochemistry

Credits: 6
Marks: 100

1. Organic Preparations -

a) p-nitrophenyl acetate
b) An aromatic alpha- and beta-glucoside starting with glucose
c) Dinitrophenyl hydrazone of ascorbic acid or any other ketone
d) Dinitrophenyl derivative of an amino acid

2. Qualitative and Quantitative Analysis of –

a) Carbohydrates
b) Amino acids and proteins
c) Free and bound phosphate
d) Vitamin C

3. Fats: Acid number, saponification, and iodine values

4. Fractionation of egg proteins and its quantification

5. Isolation of casein from milk and its quantification

SEMESTER - II

Paper – 5 (Core): BCC 103: Methods in Molecular Biology

Credits: 4
Marks: 100

1. **Chromatin –** Heterochromatin, euchromatin. Histones and non-histone proteins, general properties of histone, packing density, nucleosomes, size, variable linkers, solenoid structure, packaging of DNA, satellite DNA. (8)
2. **Genes –** Prokaryotic and eukaryotic genes, pseudogenes, split genes, super gene family, transposons, C-value paradox, Reassociation Kinetics. (10)
3. **Mutation –** Types of mutations, mechanism of mutation, mutagenic agents. DNA repair: UV repair system in *E. coli*. (5)
4. **Recombinant DNA methods –** Features of commonly used vectors, strategies for cloning in various vectors and identification of bacterial colonies containing recombinant plasmids and bacteriophage vectors. Restriction enzymes. (8)

5. Construction and analysis of c-DNA and genome libraries, protocols and strategies for c-DNA cloning, analysis of genomic DNA by southern hybridization, amplification of DNA by polymerase chain reaction, penetration of radiolabeled DNA and RNA probes, synthetic oligonucleotide probes, expression of cloned genes in cultured cells, screening expression with antibodies and oligonucleotides. (8)

6. **DNA sequencing,** foot printing, Rapid DNA sequencing methods; Maxam-Gilbert technique, Sanger's Dideoxynucleotide sequencing, gene walking, RNA sequencing. (6)

7. **Applications of recombinant technology –** Production of insulin, drug, vaccines, diagnostic probe of genetic diseases, Gene therapy. (10)

Paper – 6 (Core): BCC 104: Bioenergetics and Metabolism I

Credits: 4
Marks: 100

1. **Bioenergetics –** Concept of free energy, standard free energy, determination of ΔG for a reaction. Relationship between equilibrium constant and standard free energy change, biological standard state & standard free energy change in coupled reactions. Biological oxidation-reduction reactions, redox potentials, relation between standard reduction potentials & free energy change (derivations and numericals included). High energy phosphate compounds – introduction, phosphate group transfer, free energy of hydrolysis of ATP and sugar phosphates alongwith reasons for high ΔG. Energy charge. (8)

2. **Coenzymes and Cofactors –** Role and mechanism of action of $NAD^+/NADP^+$, FAD, lipoic acid, thiamine pyrophosphate, tetrahydrofolate, biotin, pyridoxal phosphate, B_{12} coenzymes and metal ions with specific examples. (10)

3. **Intermediary Metabolism –** Approaches for studying metabolism. (2)

4. **Carbohydrates –** Glycolysis, various forms of fermentations in micro-organisms, citric acid cycle, its function in energy generation and biosynthesis of energy rich bond, pentose phosphate pathway and its regulation. Gluconeogenesis, glycogenesis and glycogenolysis, glyoxylate and Gamma aminobutyrate shunt pathways, Cori cycle, anaplerotic reactions, Entner-Doudoroff pathway, glucuronate pathway. Metabolism of disaccharides. Hormonal regulation of carbohydrate metabolism. Energetics of metabolic cycle. (18)

5. **Amino Acids –** General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids. Special metabolism of methionine, histidine, phenylalanine, tyrosine, tryptophan, lysine, valine, leucine, isoleucine and polyamines. Urea cycle and its regulation. (14)

Paper – 7 (Core): BCC 105 : Metabolism II

Credits: 4
Marks: 100

1. **Lipids –** Introduction, hydrolysis of tri-acylglycerols, α-, β-, ω- oxidation of fatty acids. Oxidation of odd numbered fatty acids – fate of propionate, role of carnitine, degradation of complex lipids. Fatty acid biosynthesis, Acetyl CoA carboxylase, fatty acid synthase, ACP structure and function,

Lipid biosynthesis, biosynthetic pathway for tri-acylglycerols, phosphoglycerides, sphingomyelin and prostaglandins. Metabolism of cholesterol and its regulation. Energetics of fatty acid cycle. (20)

1. **Nucleotides –** Biosynthesis and degradation of purine and pyrimidine nucleotides and its regulation. Purine salvage pathway. Role of ribonucleotide reductase. Biosynthesis of deoxyribonucleotides and polynucleotides including inhibitors of nucleic acid biosynthesis. (10)
2. **Porphyrins –** Biosynthesis and degradation of porphyrins. Production of bile pigments. (5)
3. Biochemistry of biological nitrogen fixation. (4)
4. **Plant Hormones –** Growth regulating substances and their mode of action, molecular effects of auxin in regulation of cell extension, effects of gibberllic, abscisic acids and cytokinins in the regulation of seed dormancy, germination, growth and development. (10)
5. **Biosynthesis of Vitamins –** Ascorbic acid, thiamine, pantothenic acid and Folic acid. (6)

Paper 8 (Core): BCC 106: Immunology

Credits 4
Marks: 100

1. **Introduction to immune system –** Innate and acquired immunity. Structure and functions of primary and secondary lymphoid organs. (5)
2. **Cells involved in immune responses –** Lymphoid cells (B-lymphocytes, T-lymphocytes and Null cells), mononuclear cells (Phagocytic cells and their killing mechanisms), granulocytic cells (neutrophils, eosinophils and basophils), mast cells and dendritic cells. (5)
3. **Nature of antigen and antibody –** Immunogenicity vs antigenicity, factors influencing immunogenicity, epitopes, haptens, adjuvants and mitogens. Classification, fine structure and functions of immunoglobulins, antigenic determinants on immunoglobulins, isotypic, allotypic and ideotypic variants. (8)
4. **Generation of Diversity in immune system –** Clonal selection theory – concept of antigen specific receptor. Organization of immunoglobulin genes: generation of antibody diversity, T-cell receptor diversity. (8)
5. **Immune effector Mechanisms –** Kinetics of primary and secondary immune responses, complement activation and its biological consequences, cytokines and co-stimulatory molecules: role in immune responses, antigen processing and presentation. (8)
6. **Major histocompatibility complex (MHC) genes and products –** Polymorphism of MHC genes, role of MHC antigens in immune responses, MHC antigens in transplantation. (5)
7. **Measurement of antigen-antibody interactions –** Agglutination, precipitation and opsonization, gel diffusion (Ouchterlony double immunodiffusion and Mancini's Radial Immunodiffusion), immunoblotting, RIA, ELISA and ELISPOT. (7)
8. **Tolerance vs activation of immune system –** Immune tolerance, hypersensitivity (Types I, II, III, IV). (3)
9. **Disorders of immune responses –** Autoimmunity, congenital immunodeficiencies, acquired immunodeficiencies. (5)

Practical Paper – 2 (Core): BCP 402:Bioanalytical Techniques

Credits: 3
Marks: 100

1. Titration of a weak acid using a pH meter, preparation of buffers
2. Verification of Beer-Lambert's law and determination of absorption coefficients
3. Paper chromatography – Separation of amino acids and carbohydrates in a mixture
4. Thin layer chromatography of fatty acids
5. Column chromatography – Separation of a mixture of proteins and salt using Sephadex column
6. Electrophoresis

Practical Paper – 3 (Core): BCP 403: Microbiology and Immunology

Credits: 3
Marks: 100

1. Preparation of stains and reagents
2. Preparation of various culture media
3. Preparation of broth and slants
4. Sterilization of culture media by autoclave method
5. Sterilization of glassware by hot air oven
6. Isolation and propagation of bacteria
7. Staining of bacteria – Simple staining, differential staining, staining of spores and capsules
8. Determination of growth curve of bacteria
9. Biochemical tests and motility for the identification of bacteria
10. Precipitin reaction by double immunodiffusion and radial immunodiffusion (Ouchterlony and Mancini's methods)
11. Detection of antibodies or antigen by ELISA (Indirect and Sandwitch ELISA)
12. Detection of antigens by immunoblotting techniques

SEMESTER III

Paper – 9 (Core): BCC 107 : Enzymology

Credits: 4
Marks: 100

1. **Kinetics of enzyme action –** Concept of ES complex, active site, specificity, derivation of Michaelis-Menten equation for uni- substrate reactions. Different plots for the determination of K_m & V_{max} and their physiological significances. Importance of K_{cat}/K_m. Kinetics of zero & first order reactions. Significance and evaluation of energy of activation. Collision & transition state theories. Michaelis – pH functions & their significance. Classification of multi substrate reactions with examples of each class. Derivation of the rate of expression for Ping Pong, random & ordered Bi-Bi mechanisms. Use of initial velocity, inhibition and exchange studies to differentiate between multi substrate reaction mechanism. Reversible and irreversible inhibition. Competitive, non-

competitive, uncompetitive, linear-mixed type inhibitions and their kinetics, determination of K_i and numerical based on these. Suicide inhibitor. (20)

2. **Mechanism of Enzyme Action –** Acid-base catalysis, covalent catalysis, proximity, orientation effect. Strain & distortion theory. Chemical modification of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin, lysozyme, glyceraldehyde 3-phosphate dehydrogenase, aldolase, carboxypeptidase, triose phosphate isomerase and alcohol dehydrogenase. (15)
3. **Enzyme Regulation –** General mechanisms of enzyme regulation, product inhibition. Reversible (glutamine synthase & phosphorylase) and irreversible (proteases) covalent modifications of enzymes. Mono cyclic and multicyclic cascade systems with specific examples. Feed back inhibition and feed forward stimulation. Allosteric enzymes, qualitative description of "concerted" & "sequential" models for allosteric enzymes. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate transcarbamoylase & phosphofructokinase. Protein-ligand binding measurement, analysis of binding isotherms, Hill and Scatchard plots. (15)
4. **Multienzyme system –** Occurrence, isolation & their properties: Mechanism of action and regulation of pyruvate dehydrogenase & fatty acid synthase complexes. Enzyme-enzyme interaction, multiple forms of enzymes with special reference to lactate dehydrogenase. (5)

Paper -10 (Core): BCC 108 : Plant Biochemistry

Credits: 4
Marks: 100

1. **Electron transport system in plants,** oxidative phosphorylation, mitochondrial respiratory complexes, order and organization of electron carriers, electrochemical gradient, chemiosmotic theory, ATP synthase and mechanism of ATP synthesis. (6)
2. **Nitrate assimilation,** structural features of nitrate reductase and nitrite reductase, incorporation of ammonia into organic compounds, regulation of nitrate assimilation. (4)
3. **Photosynthesis –** Photosynthetic apparatus, pigments of photosynthesis, role of carotenoids, photosystems I and II, their location; Hill reaction, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photophosphorylations, complexes associated with thylakoid membranes; light harvesting complexes, path of carbon in photosynthesis – C_3 and C_4 pathway of carbon reduction and its regulation, Photorespiration. (12)
4. **Special features of secondary plant metabolism,** terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, waxes, alkaloids, biosynthesis of nicotine, functions of alkaloids, cell wall components. (8)
5. **Toxins of plant origin –** mycotoxins, phytohemagglutinins, lathyrogens, nitriles, protease inhibitors, protein toxins. (8)
6. **Stress metabolism in plants –** Environmental stresses, salinity, water stress, heat, chilling, anaerobiosis, pathogenesis, heavy metals, radiations and their impact on plant growth and metabolism, criteria of stress tolerance. (10)
7. **Antioxidative defence system in plants –** reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defence mechanism. (5)

Paper - 11 (Core): BCC 109 : Clinical Biochemistry

Credits: 4
Marks: 100

1. **Disorders of Carbohydrate Metabolism –** Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia. (7)
2. **Disorders of Lipids –** Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia. (7)
3. **Inborn Errors of Metabolism –** Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, Histidinemia. (6)
4. **Digestive diseases –** Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea. (6)
5. **Disorders of liver and kidney –** Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. (5)
6. **Electrolytes and acid-base balance –** Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. (5)
7. **Diagnostic Enzymes –** Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH. (3)
8. **Abnormalities in Nitrogen Metabolism –** Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance. (5)
9. **Blood Clotting –** Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants. (6)
10. **Cancer** – Cellular differentiation, carcinogens and cancer therapy (5)

Paper – 12 (Major Elective): BCE 201: Molecular Biology

Credits: 4
Marks: 100

1. **DNA Replication –** Mechanism of replication, the replicons, origin, primosome & replisomes, properties of prokaryotic and eukaryotic DNA polynerases, synthesis of leading and lagging starnd, difference between prokaryotic and eukaryotic replication. (8)
2. **Mechanisms of Transcription –** Prokaryotic transcription; promoters, properties of bacterial RNA polymerase, steps: initiation, elongation and termination. Eukaryotic transcription, promoters, enhancers factors and properties of RNA polymerase I, II and III. Reverse transcription. Inhibitors of transcription. (10)

3. **Post transcriptional processing –** Maturation of rRNA, mRNA and tRNA; RNA splicing, introns and exons, consensus sequence function. Poly A tail, 5' capping. (8)
4. **Recombination –** General recombination, site specific recombination and replicated recombination. (4)
5. **Genetic Code –** Evidence for a triple code and properties. Sequential, ubiquitous, degenerate, Wobble hypothesis, nonsense codons, deciphering of the codon, deviation in the genetic code, unusual codons. (4)
6. **Translation in Pro- and Eukaryotes –** Ribosomes, structure, functional domain and subunit assemply, cell free protein synthesis, direction of protein synthesis (Dintzis experiment), adaptor role of tRNA, formation of initiation complex, chain elongation, translocation & termination and the role of respective factors involved therein. Inhibitors of protein biosynthesis. Comparison of protein biosynthesis in prokaryotes with eukaryotes.

   Post translational processing: Proteolytic cleavage, covalent modifications, glycosylation of proteins, disulfide bond formation, ER bound ribosome, co- and post-translational protein synthesis, PRE and PRO proteins, Signal hypothesis. (15)
7. **Regulation of Transcription and Translation –** Positive and negative control, Repressor & Inducer, concept of operon, lac-, ara-, trp operons, attenuation, catabolite repression, autogenous regulation, lytic cycle of bacteriophage; stringent responsee of rRNA synthesis. Hormonal control, transcription factors, steroid receptors. DNA binding motifs in pro- and eukaryotes – Helix turn, helix, zinc fingers, leucine zippers/ b zip, helix loop helix motifs. (10)

Practical Paper – 4 (Core): BCP 404 : Biochemical Preparations and Clinical Biochemistry

Credits: 6
Marks: 100

1. Fractionation of cell organelles from liver and plant tissues
2. Preparation of Cytochrome C from goat heart
3. Isolation of NAD from brewer's yeast
4. Isolation and estimation of RNA and DNA from yeast, liver, and plants
5. Extraction, separation and determination of absorption spectra of plant pigments
6. Isolation and estimation of serum cholesterol
7. Qualitative and quantitative analysis of:
   (i) Saliva (α-amylase)
   (ii) Urine (urea, uric acid, glucose, proteins, Bence-Jones proteins, Cl^-, PO_3^{-3}, Ca^{+2})
8. Experiments on blood
   (a) Identification and count of blood corpuscles
   (b) Estimation of haemoglobin
   (c) Determination of A/G ratio in serum

(d) Serum creatinine and uric acid

(e) Serum enzyme assays: alkaline phosphates, SGOT, SGPT

9. Gel Electrophoresis of serum proteins
10. SDS-PAGE of proteins

SEMESTER IV

Paper – 13 (Major Elective): BCE 202 : Neurobiochemistry

Credits: 4

Marks: 100

1. **Muscle Biochemistry –** Skeletal muscle structure, plasmolemma, transverse tubules, sacroplasmic reticulum and myofibrils. Actin, myosin, tropomyosin, troponin, Z disc and H line components. Molecular mechanism of contraction, subcellular ion movements during the contraction cycle in skeletal muscle. Metabolic and functional classification of skeletal muscle fibers. Twitch, myosin ATPase activities. The motor unit. Role of calmodulin. (12)
2. **Neuromorpohology –** Organisation of neuron, dendrites and axons. Glial cells – astrocytes, oligodendrocytes, ependymal cells, Schwan cells. Nerve fiber types and functions. (6)
3. **Neurophysiology –** Excitation and conduction, generation and conduction of action potential, saltatory conduction, ion channels and transport of ions. Synaptic transmission, Neurotransmitters and Neurohormones – chemistry, synthesis, storage and release. Blood Brain CSF barrier– Characteristics, transport systems. Biochemistry of vision. (12)
4. **Transport across membrane –** Types of transport (simple diffusion, passive-facilitated diffusion), active transport – primary and secondary group translocation, transport ATPases, transport by vesicle formation. (7)
5. **Neurological disorders –** Headache, facial pain, migraine, epilepsy, stroke, selected neurocutaneous diseases, movement disorder, Benign essential (familiar) tremor, Parkinsonism, Huntington's disease, multiple sclerosis, motor neuron disease, Myasthenia Gravis. (15)

Paper – 14 (Major Elective): BCE 203 : Outlines of Biotechnology

Marks: 100

1. **Plant genetic engineering** and prospects of improving crop productivity, gene isolation, gene transfer systems, Ti plasmid, plant virus vectors, electroporation, microinjection, microprojectile technology, gene expression, regeneration. Application in relation to protein quality, photosynthetic efficacy, nitrogen fixation efficiency and resistance to environmental stresses. (10)
2. **Tissue culture** – Plant tissue culture, anther and pollen culture, protoplast culture, protoplast fusion, embryo rescue, animal cell lines and organ culture. (8)
3. **Transgenic plants and animals** (3)

4. **Fermentation technology** – Fermentors, general design of fermentor, fermentation processes, production of alcohols, antibiotics, steroids and enzymes; biotransformation, biomass & production of single cell protein. (8)
5. **Hybridoma technology** – Monoclonal antibodies, selection of hybrids, hybridomas, purification and application of monoclonal antibodies. (5)
6. **Xenobiotics metabolism** – Biodegradation, detoxification of xenobiotics by microorganisms, biodegradation of hydrocarbons, pesticides, surfactants, polyaromatic hydrocarbons, dyes; role of Cytochrome P_{450} in detoxification. (6)
7. **Proteomics**- Genome to Proteome, Steps and tools for proteome analysis. (3)
8. **Enzyme Technology** - Large scale production of enzymes, enzyme reactors, immobilization of enzymes by chemical and physical methods. Effect of partition on kinetics and on changes in pH and hydrophobicity. Applications: fundamental studies of biochemistry, synthetic organic chemistry, industry, food technology, medicines. Synzymes, enzyme electrodes & biosensors. (10)

Practical – 5 (Core): BCP 405 : Enzymology and Enzyme Technology

Credits: 6

Marks: 100

1. Assay of enzyme activity
2. Isolation and purification of urease
3. Time course of enzymatic reaction
4. Influence of substrate concentration on the rate of enzymatic reaction
5. Effect of pH and temperature on the rate of enzyme reaction
6. Specificity of enzyme action
7. Inhibition of enzyme activity. Determination of Ki values
8. Molecular weigh determination of enzyme by gel filtration
9. Isozyme detection
10. Immobilization studies:
    (a) Preparation of urease entrapped in alginate beads and determination of percent entrapment
    (b) Study of the kinetics of the rate of urea hydrolysis by urease entrapped alginate beads
    (c) Study of reusability and storage stability of urease entrapped alginate beads
    (d) Immobilization of urease by covalent attachment to solid support.

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